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# Acoustical Characteristics in Vocal Cord Palsy Secondary to Bronchogenic Carcinoma - A Case Report

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**Abstract:** ***Bronchogenic carcinoma, commonly known as lung cancer, It is a widespread and deadly form of cancer, with higher incidence and mortality rate, especially among men, making it a significant global health concern. . This aggressive form of cancer can cause vocal cord paralysis, leading to symptoms such as a low, raspy, and hoarse voice. It is commonly associated with individuals who have a long - term history of smoking, especially men. In the context of this discussion, we are presenting a case study involving a 70 - year - old male who developed unilateral vocal cord palsy as a secondary complication of bronchogenic carcinoma.***

**Keywords:** Unilateral vocal cord palsy, bronchogenic carcinoma, acoustic analysis

## 1. Introduction

Vocal cord paralysis can be the result of various neural impairments that impact the function of the vocal cords. The complex network of nerves responsible for controlling the vibration of the vocal cords originates from the nucleus ambigus in the brainstem. The primary nerve involved in the movement of the vocal cords is the Vagus nerve, which is the largest nerve in the human body and extends throughout the thoracic and abdominal cavities [1]. Branching off from the Vagus nerve are two slender branches that innervate the larynx at the base of the skull. These branches are known as the "superior laryngeal nerve" and the "recurrent laryngeal nerve (RLN). " The recurrent laryngeal nerve is responsible for conveying commands to both the opening and closing muscles of the larynx. When this nerve is affected, it can lead to paralysis of these muscles, resulting in compromised basic functions and difficulties such as respiratory problems, hoarseness, and aspiration issues due to the failure of proper closure. Vocal cord paralysis is caused by various pathologies, one of which is bronchogenic carcinoma.

Bronchogenic carcinoma, is a prevalent and significant health issue globally, both in terms of its occurrence and its impact on mortality. In 2012, there were an estimated 1.8 million new cases of lung cancer, with a substantial 58% of these cases reported in developing countries. This cancer type is the most frequently diagnosed cancer in men worldwide, contributing to 1.2 million new cases. Shockingly, it is also the leading cause of cancer - related deaths, responsible for an alarming 1.59 million deaths annually. Although the incidence rates in females are initially lower than in males, they are showing a worrying trend of increase over time [1]. Notably, in a country like India, the occurrence of lung cancer and associated mortality are on the rise, a trend largely attributed to evolving smoking practices. Research has consistently shown a compelling and undeniable link between smoking and lung cancer, with notable variations in relative risk rates among different communities. This detailed information underscores the critical need for increased awareness, preventive measures, and comprehensive efforts aimed at curbing the incidence and impact of this formidable disease on global health.

In India, lung cancer primarily affects men around the age of 54. The most common types of lung cancer in India include squamous cell carcinoma, adenocarcinoma, small cell carcinoma, and large cell carcinoma. Adenocarcinoma is more prevalent in nonsmokers and females. Tobacco smoking is the leading cause of lung cancer, and the link between smoking and lung cancer was firmly established in the 1950s after extensive research. Even after 10 - 20 years of quitting smoking, the risk of developing lung cancer is still about 2.5 times higher than that of nonsmokers. We are reporting a case of unilateral vocal cord paralysis as a result of bronchogenic carcinoma in a 70 - year - old adult.

## 2. Case Report

In this article a case of a 70 - year - old male with bronchogenic carcinoma, who previously had tuberculosis and COPD that had gone into remission, was referred to the Department of Audiology and Speech - Language Pathology. He presented with the complaint of progressive loss of voice over a month. The patient has been a chronic smoker for approximately 15 years, smoking around 10 to 12 cigarettes per day. Stroboscopic examination revealed the left vocal cord is fixed in the paramedian position and a phonatory gap was present and the right vocal cord was mobile. Ventricular fold approximation was absent. The results suggest left recurrent laryngeal nerve compression due to branchiogenic carcinoma.

Medical history reveals bronchogenic carcinoma with nodal, lung, and liner metastasis T4 N3 M1 B, Cholangiocarcinoma with metastasis.

**Radiology:**
The CT (computed tomography) of the neck revealed a lesion in the prevascular space, right lower paratracheal space, and left hilar - possible malignant lesion.

**Evaluation of voice:**

**Perceptual evaluation of voice:**
The patient's voice was perceptually assessed using GRABAS scale, revealing a score of Grade=3, Roughness=1, Breathiness=3, Asthenic= 3 Strained=2. The maximum phonation duration was as follows: /a/ = 2 seconds, /i/ = 2 seconds, /u/ = 3 seconds. He also exhibited a weaker cough, less muscular skeletal tension, and reduced loudness.

**Acoustic analysis:**
The voice analysis was conducted using Praat software version 5.2.35 at a frequency of 44, 000 Hz, with consideration of the microphone specifications. The microphone used was a dynamic cardioid positioned 45 degrees laterally from the mouth to avoid interference from nasal breaths and placed 10 cm away from the mouth. The participant was seated comfortably and instructed to produce a sustained vowel /a/ for at least 6 seconds, using their habitual pitch and loudness after taking a deep breath.

**Table 1:** The acoustic analysis of unilateral vocal cord paralysis

| Acoustic parameters of voice | /a/ |
|---|---|
| Average Fundamental Frequency | 364.2 |
| Highest Fundamental Frequency | 467.8 |
| Lowest Fundamental Frequency | 105.6 |
| Average Intensity | 59.27 |
| Highest Intensity | 64.15 |
| Lowest Intensity | 53.3 |
| Shimmer | 22.20% |
| APQ | 12.40% |
| Jitter | 6.60% |
| PPQ | 3.71% |
| Harmonic to noise ratio (HNR) | 1.8 |
| Noise to harmonic ratio (NHR) | 0.7 |

## 3. Discussion

The incidence and mortality of bronchogenic carcinoma make it the most common type of cancer. This cancer is becoming more prevalent in India due to changes in smoking habits. Bronchogenic carcinoma has been found to be responsible for up to 43% of cases of unilateral vocal cord paralysis [1]. When pulmonary carcinoma is categorized as T4 (stage IB) and is linked with unilateral cord paralysis, initial surgery is generally not considered. In such cases, cord paralysis may result from direct infiltration of the recurrent laryngeal nerve by a locally spreading tumor, metastasis, involvement of neighboring lymph nodes, intrathoracic compression by the tumor, or displacement of nearby structures. or neuromuscular inactivation. In our case study, the patient was at the stage of T4 with unilateral vocal cord palsy and the acoustic parameters of voice revealed increased fundamental frequency (364.2 Hz), jitter (6.6%), and reduced intensity (59.27 dB). These results obtained in the case report are similar to the study conducted by Jesus et al. in 2015, which states that significant alterations in various acoustic parameters can be caused due to unilateral vocal fold paralysis, which includes mean F0, jitter, shimmer, and mean harmonics - to - noise ratio.

**Declaration by Authors**
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